



Missouri Department of Natural Resources

## Total Maximum Daily Load Information Sheet

### Strother Creek

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#### Water Body Segment at a Glance:

<b>Counties:</b>	Reynolds/Iron
<b>Nearby Towns:</b>	Between Bixby and Oates
<b>Length of impaired segment:</b>	7 miles classified
<b>Length of impairment :</b>	2.1 miles classified 1.0 mile unclassified
<b>Pollutants:</b>	Arsenic, Lead, Nickel and Zinc
<b>Source:</b>	Buick Mine
<b>Water Body IDs:</b>	2751 and 2751U-01



**Scheduled for TMDL development: 2012**

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#### Description of the Problem

##### Designated beneficial uses of Strother Creek

- Livestock and Wildlife Watering
- Protection of Warm Water Aquatic Life
- Protection of Human Health (Fish Consumption)

##### Use that is impaired

- Protection of Warm Water Aquatic Life
- General Criteria

##### Standards that apply

- Missouri has no standards for metals in sediment. Likewise, the U.S. Environmental Protection Agency has not yet established federal guidelines for toxic chemicals in stream or lake sediments. In lieu of such criteria, Probable Effect Levels, or PELs, suggested by McDonald, et al<sup>1</sup>, are used. PELs are the concentrations at which some toxic effect on aquatic life is likely.
- In addition, all water bodies in Missouri are protected by the general criteria contained in Missouri's Water Quality Standards, or WQS, 10 CSR20-7.031(3). These criteria are also called narrative criteria. The particular general criteria that apply to Strother Creek are:

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<sup>1</sup> *Development and Evaluation of Consensus-Based Sediment Quality Guidelines for Freshwater Ecosystems*, D. MacDonald, et al., 2000

- (D) Waters shall be free from substances or conditions in sufficient amounts to result in toxicity to human, animal or aquatic life.
- (G) Waters shall be free from physical, chemical or hydrologic changes that would impair the natural biological community.

### **Background information and water quality data**

Strother Creek is a small Ozark stream in western Iron County, Mo. It flows east to join the Middle Fork Black River. Metals impairment is evidenced in water quality data, invertebrate density and toxicity studies in Strother Creek. Data were gathered by both the U.S. Geological Survey, or USGS, and the department from 2002-2007.

In the unclassified segment of Strother Creek (WBID 2751U-01), below the Buick Mine, levels of arsenic are more than twice the PEL value and levels of nickel, lead and zinc are six to twelve times higher than PEL values (graphs below). Therefore, this segment of Strother Creek is judged to be impaired by arsenic, nickel, lead and zinc in sediments (see map on last page). The classified segment of Strother Creek between WBID 2751U-01 and Neals Creek had levels of nickel, lead and zinc two to three times the PEL values, so that segment of Strother Creek is judged to be impaired by nickel, lead and zinc in sediments. There are three lines of evidence for these impairments.

First, toxicity testing was conducted on several stream sites in the New Lead Belt by the USGS in 2002 and 2004. The results were compared to streams unaffected by mine/mill discharges. The tests indicated toxic results in Strother Creek below the Buick Mine. Based on these tests a portion of Strother Creek below the Buick mine is judged to be impaired due to toxicity.

Next, invertebrate monitoring by USGS<sup>2</sup> used the department's metric scoring for one habitat type (riffle). This monitoring found impaired aquatic invertebrate communities on Strother Creek below the Buick Mine (between the mine outfalls and Neals Creek). Scores greater than 16 indicate no impairment. The results upstream of Neals Creek were 12 in 2003 and 10 in 2004, indicating impairment. Downstream of Neals Creek, the score was 18 in 2004.

Finally, the USGS studied crayfish density, sediment pore water chemistry<sup>3</sup> and crayfish toxicity<sup>4</sup> in several streams in and near the New Lead Belt in Southeast Missouri. Crayfish densities and pore water sampling were done in the summer of 2004, and caged crayfish studies in the summer of 2005. Crayfish are important processors of organic matter in streams and represent the largest source of food for fishes in Ozark streams. Both native crayfish abundance and caged crayfish toxicity strongly correlate with the concentration of heavy metals in sediment pore waters. Based on these data, Strother Creek between the Buick Mine outfalls and Neals Creek is judged to be impaired due to the almost complete loss of crayfish.

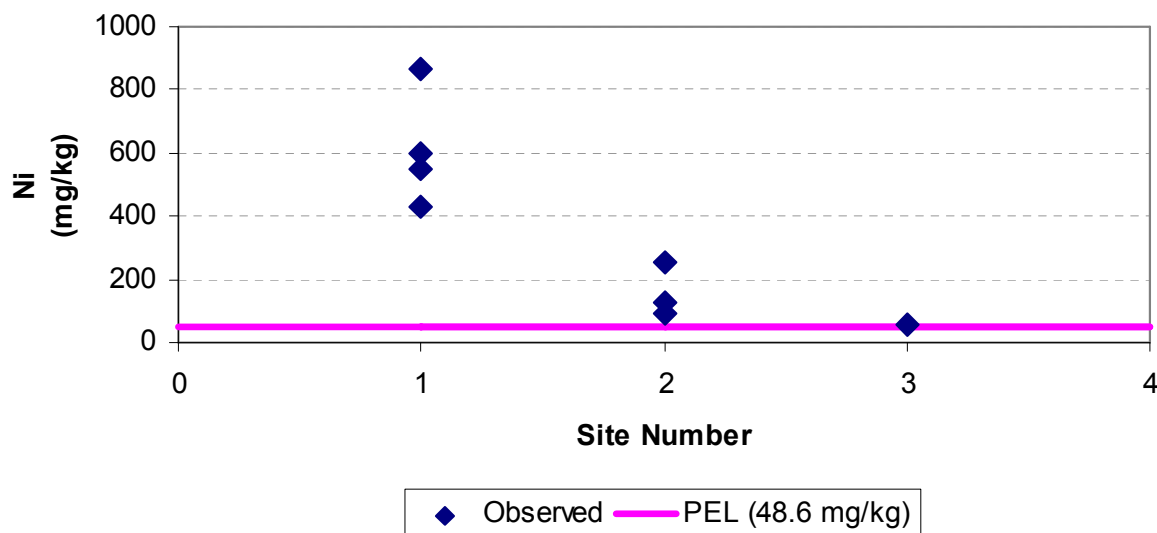
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<sup>2</sup> "A macroinvertebrate assessment of Ozark streams located in lead-zinc mining areas of the Viburnum Trend in southeastern Missouri, USA" Poulton, B. et al. , Published online: 04April 2009

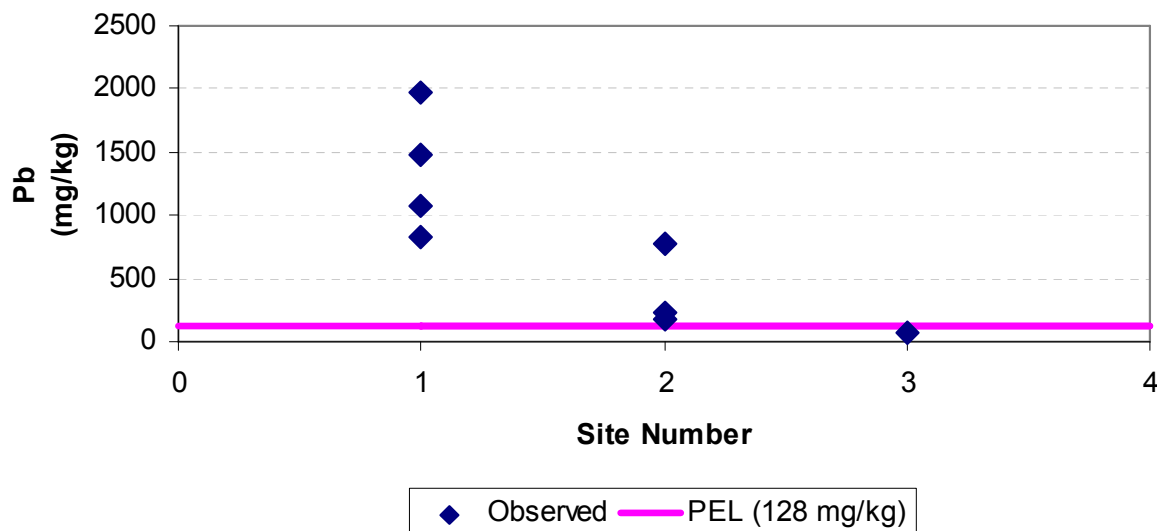
<sup>3</sup> "Effects of Lead-Zinc Mining on Crayfish (*Orconectes hylas*) in the Black River Watershed, Mo, USA" Allert, A. et al. *Freshwater Crayfish* Vol. 16, pp.97-111. 2008.

<sup>4</sup> "Ecological Effects of Lead Mining on Ozark Streams: In-Situ toxicity to woodland crayfish (*Orconectes hylas*). Allert, A. et al. *Ecotoxicology and Environmental Safety* 72 (2009) pp.1207-1219. 2009.

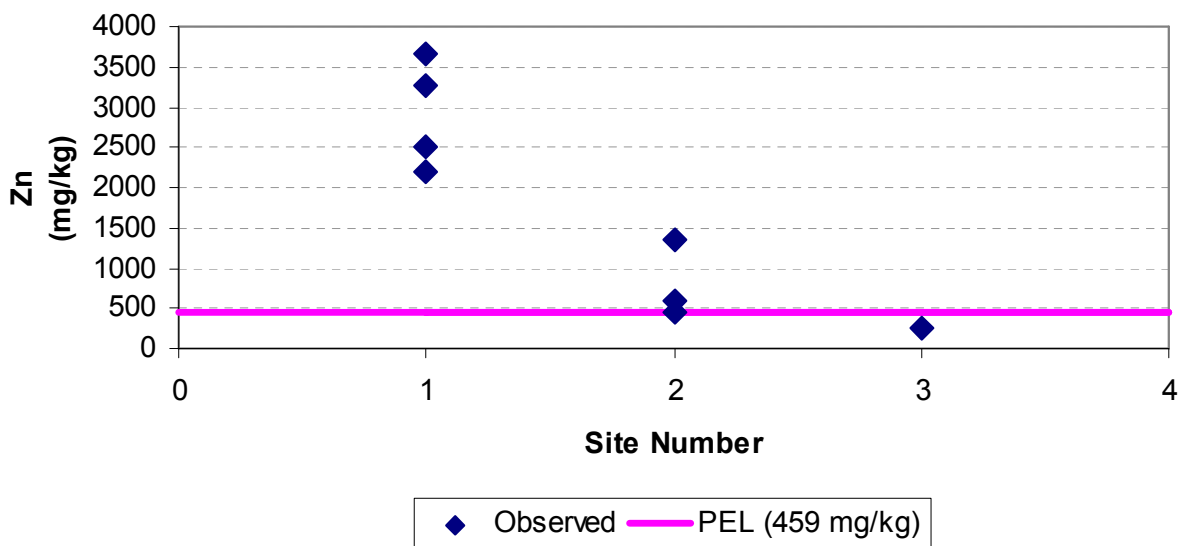
### Nickel (Ni) Sediment Data for Strother Creek from 2002 - 2007 at Three Sites



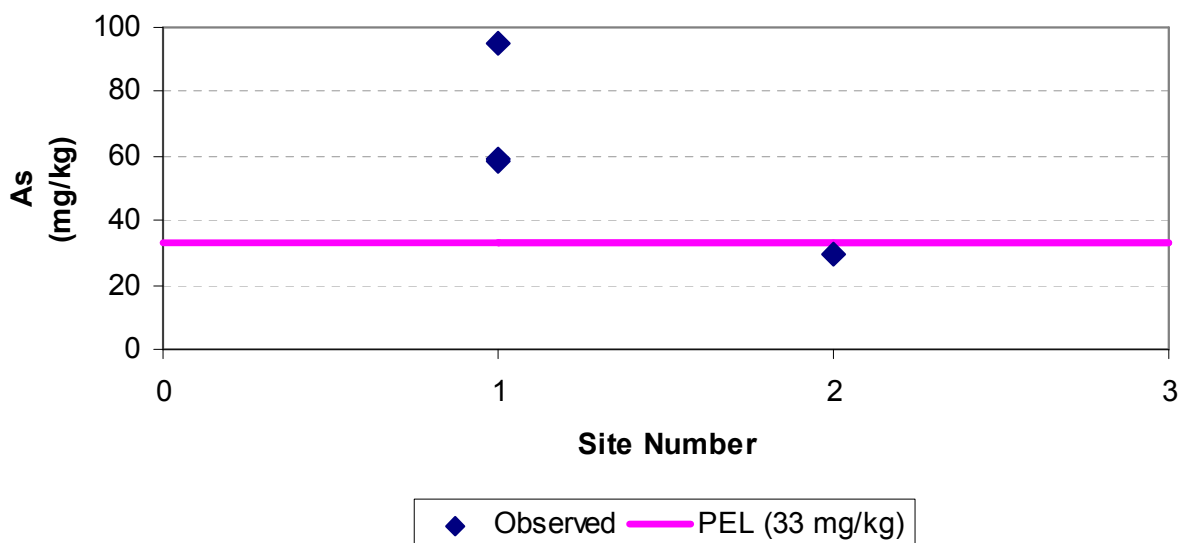
### Lead (Pb) Sediment Data for Strother Creek from 2002 - 2007 at Three Sites



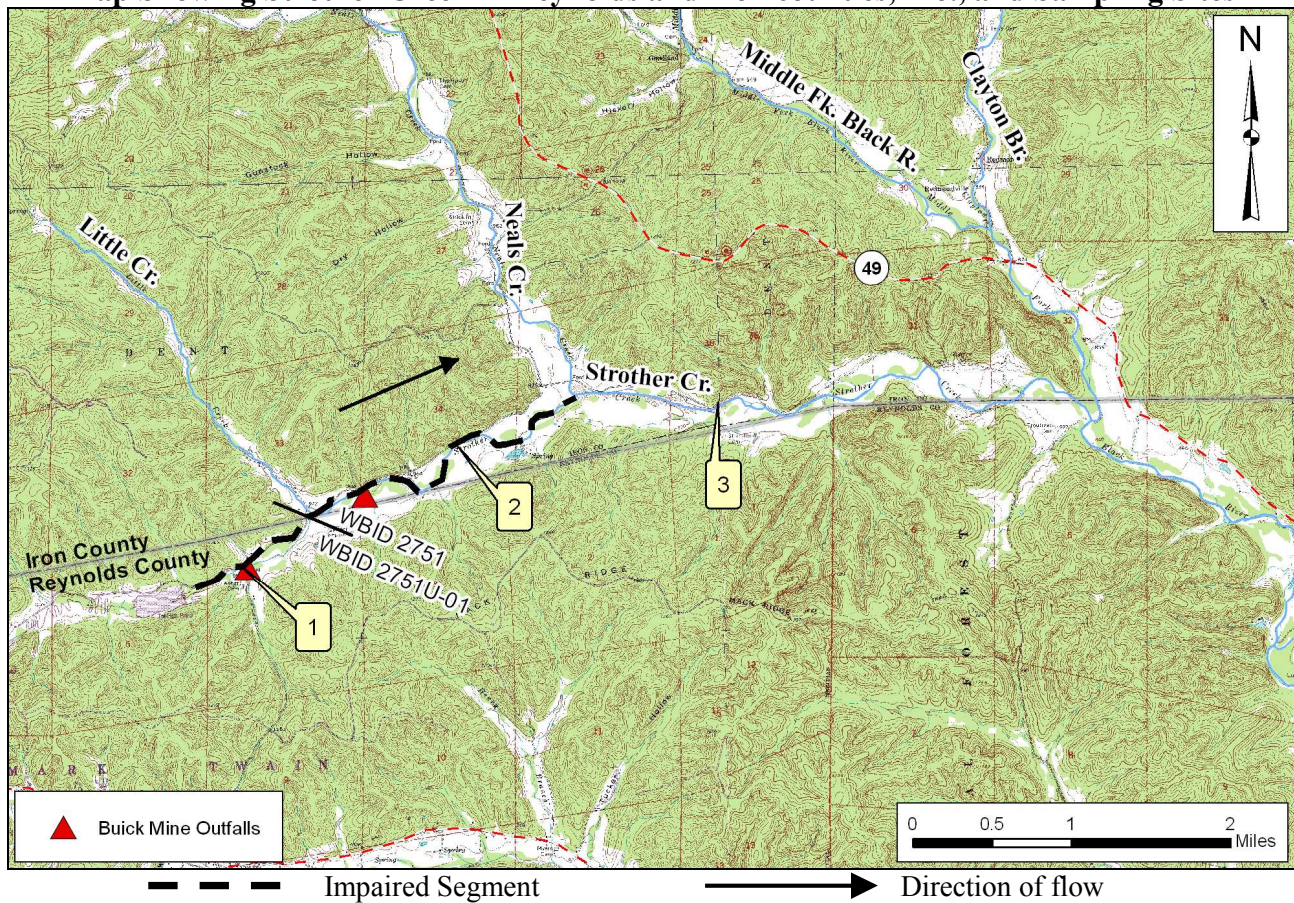
### Zinc (Zn) Sediment Data for Strother Creek from 2002 - 2007 at Three Sites



### Arsenic (As) Sediment Data for Strother Creek from 2004, 2006 and 2007 at Two Sites



**Map Showing Strother Creek in Reynolds and Iron counties, Mo., and Sampling Sites**



**Sample Sites**

- 1 – Unclassified Strother Creek at County Road 836
- 2 – Strother Creek upstream of Neals Creek
- 3 – Strother Creek 1 mile downstream of Neals Creek

**For more information call or write:**

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